Name:_____ Block:_____ Date:_____

Galileo's Ramp Lab (H)

Galileo was interested in examining the acceleration of falling objects. Because falling objects moved too quickly, he came up with the idea of using a ramp to slow down the object's motion. Our goal in this lab is to determine the acceleration of a marble rolling down a ramp and to explore how the marble's position, velocity, and acceleration change with time.

Procedure:
Record the time required for a marble to roll set distances down a 1.83 m aluminum angle ramp elevated by 3 textbooks.

- Make sure you maintain the same ramp angle for all trials.
- You should do three trials for at least 7 different distances.
- Do additional distances or trials if needed.

	Rolling Time (s)			
Position (m)	Trial 1	Trial 2	Trial 3	Average
0.25				
0.50				
0.75				
1.00				
1.25				
1.50				
1.75				

Analysis

1. Calculate the average time for the marble to roll down the ramp for each of the seven distances.

2. Using the displacement and average time, calculate the marble's average velocity when it rolled 0.25 m down the ramp. Show the formula, substitution, and calculation below.

3. Using the formula for average velocity, and the fact that the marble started from rest, determine the marble's final velocity when it rolled 0.25 m down the ramp. Show the formula, substitution, and calculation below.

4. Calculate the average acceleration of the marble down the ramp when it rolled 0.25 m using the marble's initial velocity, final velocity, and time. Show the formula, substitution, and calculation below.

5. Enter the values you calculated for 0.25 m in the table below and complete the rest of the table by referring to your sample calculations.

Distance (m)	Ave Time (s)	Ave Vel (m/s)	Final Vel (m/s)	Ave Acc (m/s^2)
0.25				
0.50				
0.75				
1.00				
1.25				
1.50				
1.75				

6. Create graphs of the following:
    a. Position vs. Time
    b. Velocity vs. Time (use your final velocity values)
    c. Acceleration vs. Time

    - Do not use a ruler to connect the points in a dot-to-dot manner.
    - Should zero-zero be a point on any of the graphs? If so, put it in.
    - For position vs. time, draw a smooth, freehand curve through the points
    - For the velocity-time and acceleration-time graphs, use a ruler to draw a single best-fit line if the points appear to be in a line.

7. Calculate the slope of your velocity-time graph. Show all work and include units.

8. Calculate the average value of your acceleration data.

Conclusion

1. What does the position-time graph of an accelerating object look like?

2. What does the velocity-time graph of an accelerating object look like?

3. What does the acceleration-time graph of an object with constant acceleration look like?

4. How does the slope of your velocity-time graph compare with the average value of your acceleration data (analysis #7 and #8)? Explain any similarities.